University of Agronomic Sciences and Veterinary Medicine of Bucharest
Faculty of Horticulture

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USAMV BUCUREȘTI
CENTRUL DE CERCETARE PENTRU STUDIUL CALITĂȚII PRODUSELOR AGROALIMENTARE

Changes in Bacterial and Fungal Soil Communities in organic berry crops

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Introduction

Cover crops:

- Cover crops are plants that are grown primarily to **protect and improve the health of soil** in between planting seasons.
- Each type of cover crop has different benefits and can be chosen to meet specific objectives such as **nitrogen fixation, weed suppression, or soil compaction reduction.**
- Cover crops can also be used to provide **habitat for beneficial insects**, such as pollinators and predators of pests, as well as to improve water quality by **reducing soil erosion and nutrient runoff**.

Flower strips:

- Flower strips are narrow strips of land that are intentionally planted with a mix of flowering plants. They are designed to **provide habitat and food for pollinators** such as bees, butterflies, and other beneficial insects. Flower strips are often planted in agricultural landscapes where they can serve as a means of **improving pollination of crops, promoting natural pest control, and providing biodiversity in the agricultural ecosystem**.
- Flower strips may consist of a single species or a mixture of species that bloom at different times throughout the growing season, providing a **continuous source of nectar and pollen** for pollinators. Some common species used in flower strips include wildflowers such as clovers, poppies, and sunflowers, as well as native grasses.
- Additionally, they can help to **reduce soil erosion and improve soil health** by promoting the growth of beneficial microorganisms.

Materials and Methods

For the study of the local microbial communities in the soil of the raspberry and strawberry plantations, soil samples were taken from the **Rodagria Agricultural Cooperative** (Ogoru, Călărași), in two moments, as follows:

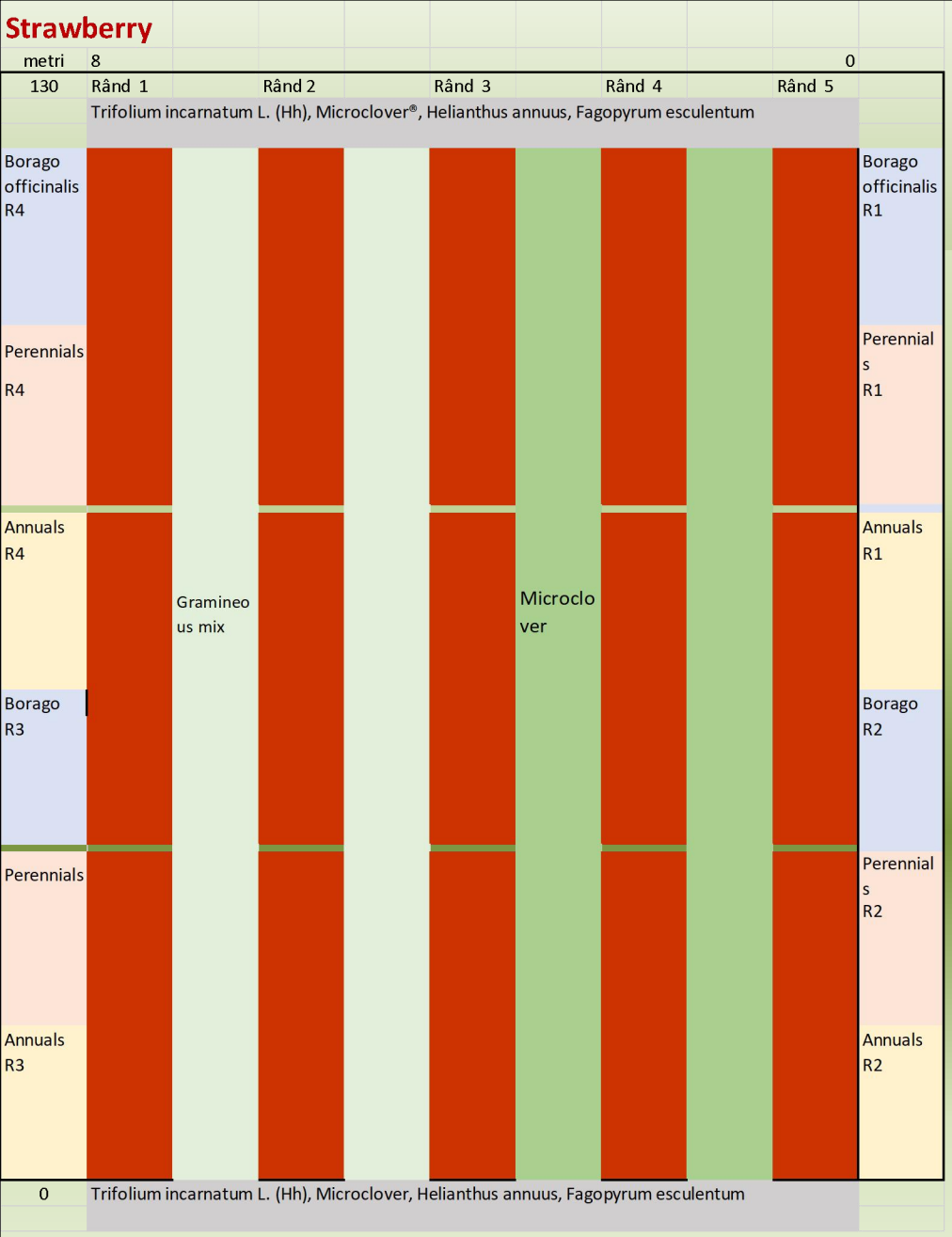
-MS 1, in **April 2022**, before sowing the companion plants and planting strawberry runners (stolons) and directly from the existing field, in raspberry.

-MS2, in October 2022, when it was considered to be the optimal period for determining microbial activity.

Samples were taken for each variant of companion plants (B = Borago O., P = perennials, A = annual) and for the cover crops (microclover and gramineous species mix).

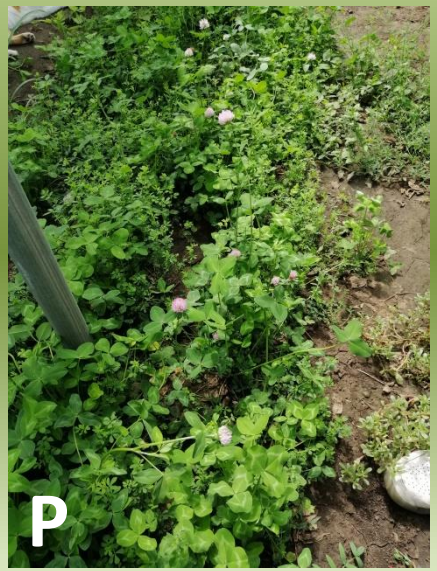
Experimental design of the raspberry project

The distribution of experimental variants (the cover strips and flower strips in the ***raspberry field***



Experimental design of the strawbery project

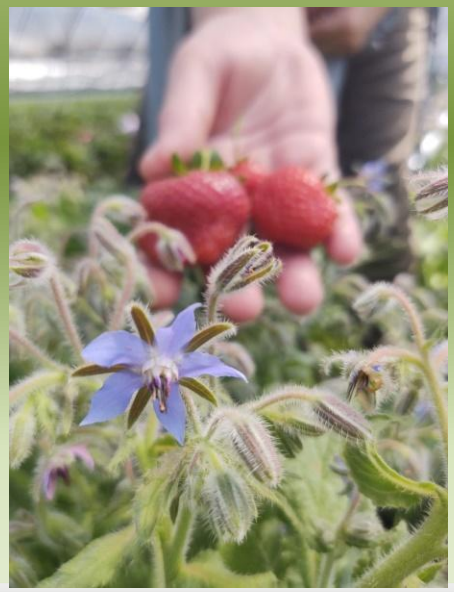
The distribution of experimental variants (the cover strips and flower strips) in the ***strawberry field***



Instalment of flower strips with companion plants in raspberry crop
(B = Borago O., P = perennials, A = annual)

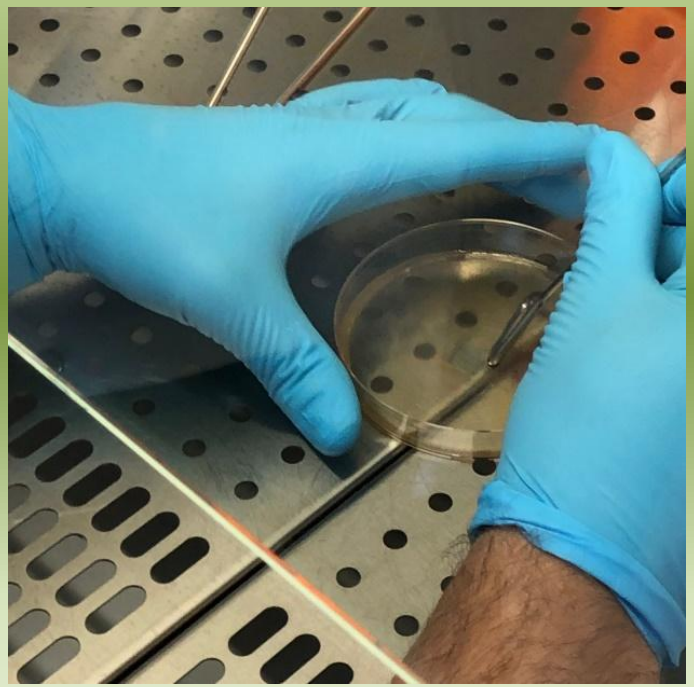
Instalment of cover crops with microclover and gramineous in *raspberry crop*
(G = Gramineous plants, M = microclover)

Instalment of flower strips with companion plants in strawberry crop



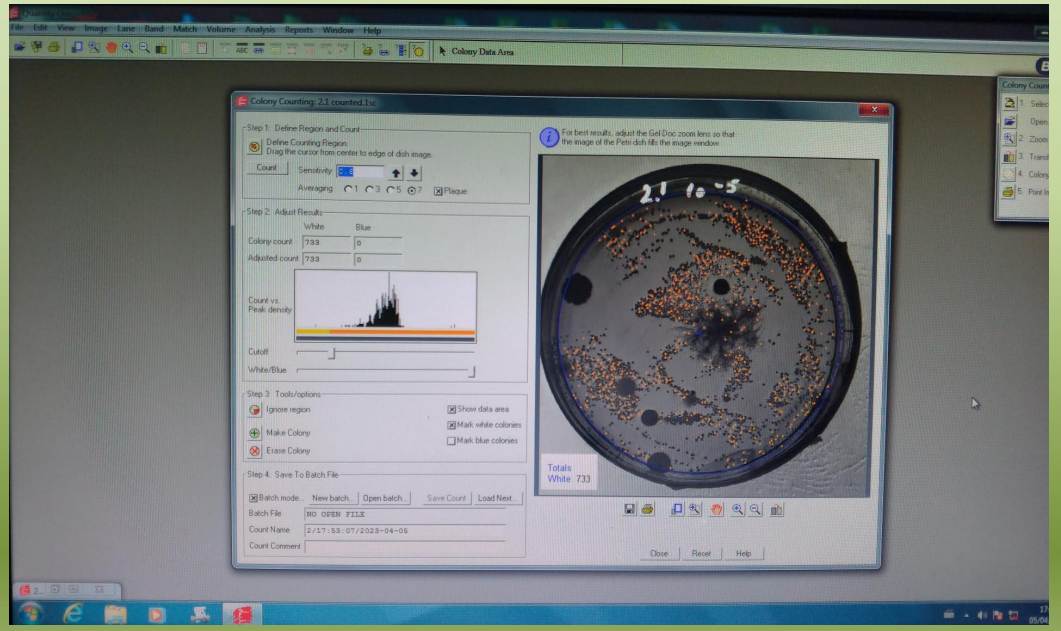
Materials and Methods

- The total number of bacteria and the total number of fungi have been determined by the **serial dilution method**, by dispersing (with Drigalski spreader) the diluted solution on the PDA medium.
- As a method of determination, the number of colonies were calculated based on colony counting (manually at Colony Counter and automatically with QuantityOne software, from Bio-Rad) at 1, 3, 5 and 7 days after inoculation, taking into account the dilution and soil moisture.



Materials and Methods

Colony Counter



Quantity one software from BIO-RAD

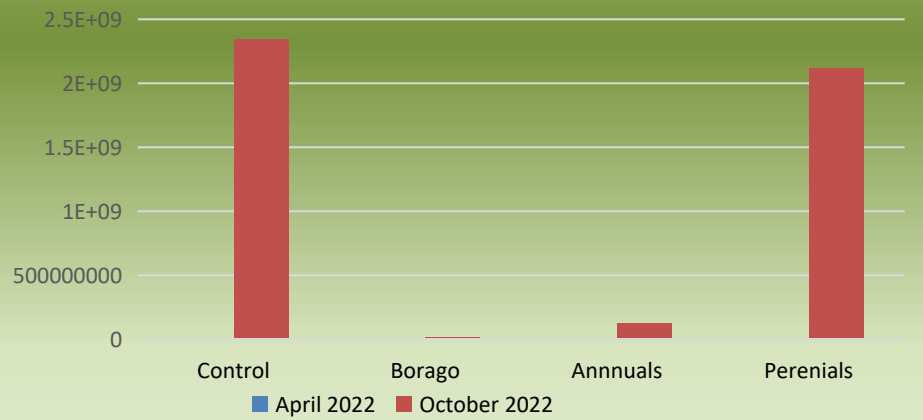
Results and discussions

It was found that in raspberry crop:

- the number of bacteria in the soil covered with grassy strips and flower strips increased during the vegetation period, being much higher in October compared to April 2022,
- the highest number of bacteria was observed in Gramineae strips, followed by control and microclover.
- in the case of flowering strips, the highest number of bacteria was observed in control and perennials, and a much lower increase in borago and annuals.

Total colony-forming unit of bacteria in cover strips, raspberry, 2022

Total colony-forming unit of bacteria in flower strips, raspberry, 2022

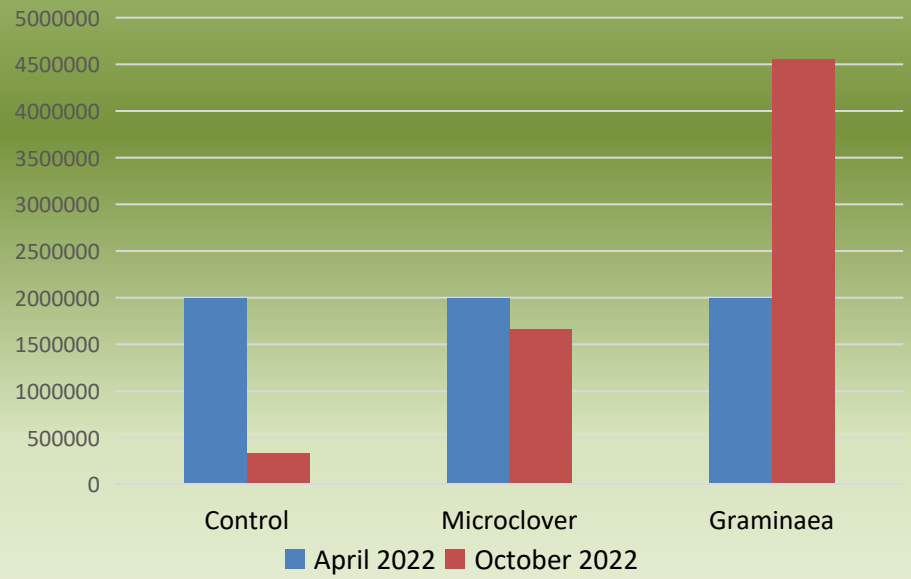


Results and discussions

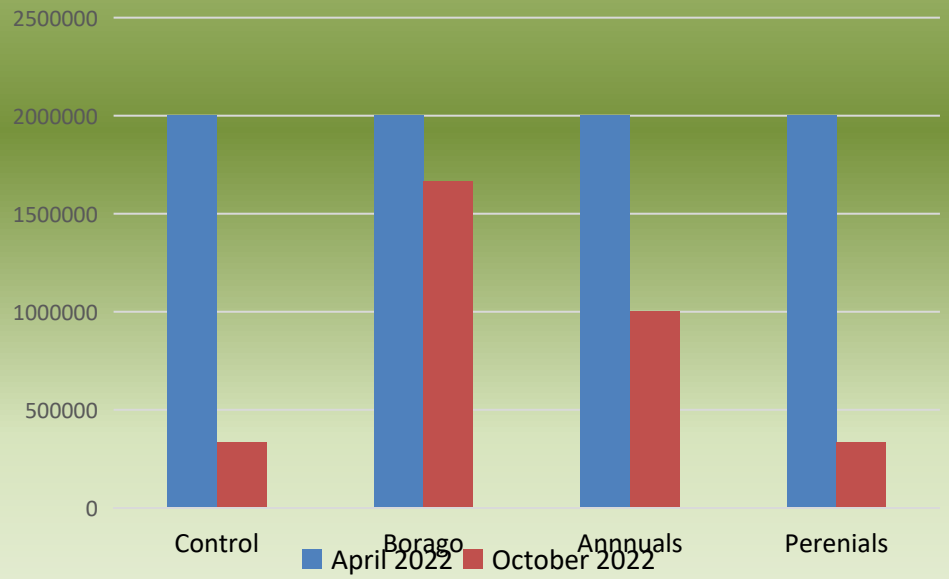
It was found that in raspberry crop:

- the number of fungi in the soil covered with grassy strips and flower strips decreased during the vegetation period, with the exception of Gramineous plants,
- the highest number of fungi was observed in Gramineae strips, followed by microclover and control.
- in the case of flowering strips, the highest number of fungi was observed in borago and annuals, but at a much lower rate.

Total number of fungi in cover strips, raspberry, 2022

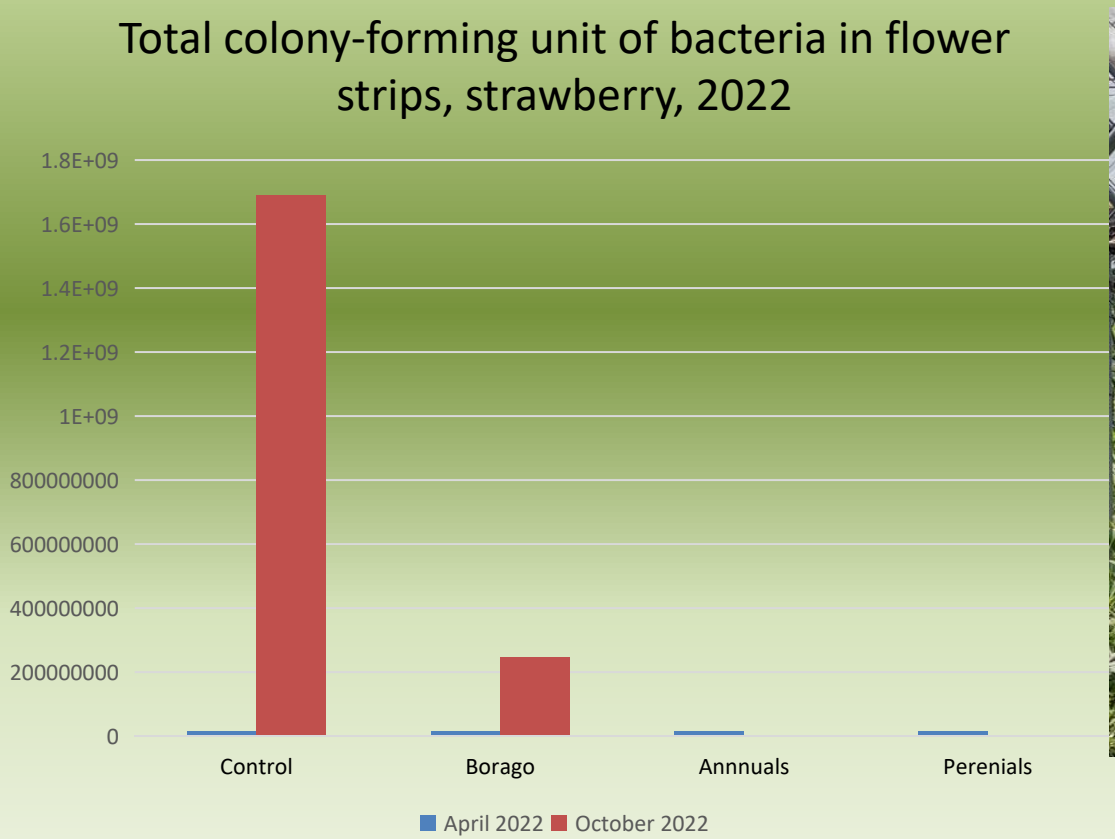


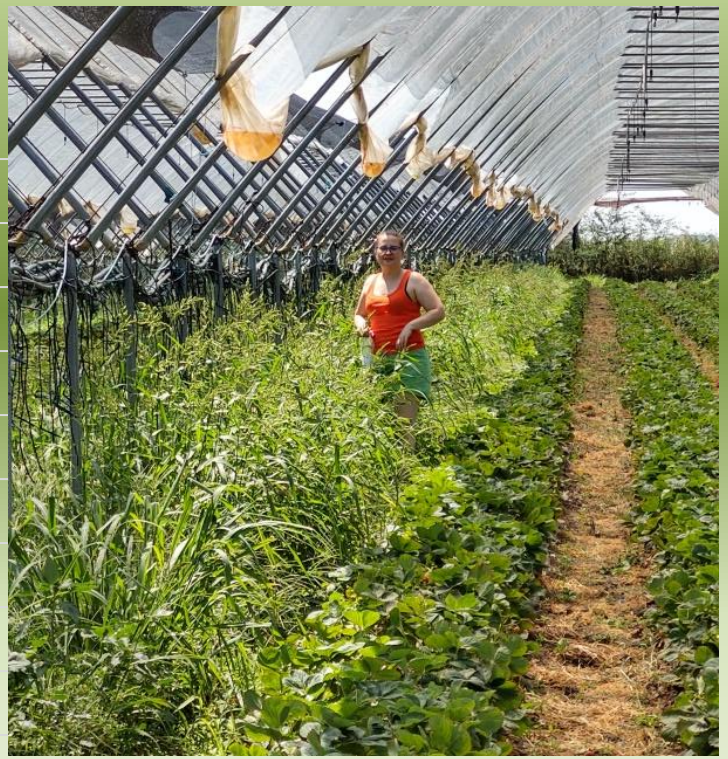
Total number of fungi in flower strips, raspberry, 2022



Results and discussions

It was found that in strawberry crop:
- cover strips in strawberry did not installed succesfully, due to water shortage,
- in flower strips, due to the Johnsongrass (*Sorghum halepense* L.) invasion, the annuals and perennials plants died
-the number of bacteria in the soil covered with flower strips increased during the vegetation period, the highest number being observed in control, followed by borago.





Johnsongrass invasion

Results and discussions

The evolution of bacterial colonies from

20 of October 2022

(3rd day of incubation)

to

24th of October 2022

(7th day of incubation)

Conclusions and recommendations

- In conclusion, in general, the number of bacteria increased from April to October, while the number of fungi decreased
- The cover strips composed from gramineous plants enriched the soil both in bacteria and fungi, at the highest rates
- In flower strips in raspberry, the control and the perenials strongly favorised the development of bacteria
- Borago proved to be a companion species that inhibit weeds growth succesfully, and can be used as a weed killer
- Borago, posibly due to their high plant foliar volume, keep the humidity below the plants at very high level, a fact that could inhibit bacterial growth but stimulates the fungi

Acknowledgment

- Resilient organic berry cropping systems through enhanced biodiversity and innovative management strategies
- Acronim: RESBERRY
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- *Project code: ERANET-COREORGANIC-ResBerry-1*

- *Contract number: 247/2021*
- *Project webpage:*
- *https://www.usamv.ro/index.php/ro/1150-resberry*

Thank you for your attention